Co-Curation as Hacking: Biohackers in Copenhagen's Medical Museion

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Abstract   In 2012, the University of Copenhagen's Medical Museion collaborated with members of the local DIY biology community to create a DIY biology lab and event series. This article discusses the project and the hacker movement more generally with reference to two current museum trends: first, the opening up of museums through external collaborations, for instance in co-curation; and second, renewed interest among science and technology museums in revealing the "behind the scenes" of research, including bringing laboratories into museums. With regard to the first trend, we suggest that hacking may be a useful framework for thinking about co-curation, and argue that co-curation needs to be understood as a process that doesn't just involve the representation of diverse narratives, but instead incorporates a range of diverse actors into the design and production of an exhibition. With regard to the second, we argue that biohacking may be a better fit to a museum's desire to exhibit research processes than traditional scientific laboratories, given biohacking's emphasis on enabling citizens to understand and carry out scientific research. We develop these suggestions by charting the course of the collaboration.

INTRODUCTION

In 2012, the University of Copenhagen's Medical Museion opened a small DIY biology lab (referred to here as a lab/installation to highlight its hybrid character)[1] entitled Biohacking: Do It Yourself! (hereafter B: DIY), and hosted an accompanying event series. The B: DIY project was a collaboration between the Medical Museion, two biohackers associated with the local biohacking space Biologigaragen, and the University of Copenhagen Center for Synthetic Biology. This article analyzes and reflects on that collaboration.[2]

The project is of particular interest for museum studies and curatorial reflection due to its intersection with two important trends within contemporary museum practice: 1) the call for museums to become more open to users and stakeholders via co-curation; and 2) interest in showing "science-in-the-making." To date, the latter is often manifested as an instance of the former, with laboratory practice and the ways in which scientific knowledge is developed through it being brought into the museum via co-curation with scientists or scientific institutions. We argue that the intersection of these two trends in Medical Museion's biohacking project suggests the wider utility of the notion and practice of hacking. Hacking and, relatedly, maker culture are approaches which emphasize hands-on skills and problem solving,

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particularly with regard to technology but also more generally (Anderson 2012; Levy 1984; Delfanti 2010). In other words, we suggest that co-curation in museums can be thought of in terms of hacking, and that biohacking, in particular, is a good fit to satisfy the desire to exhibit laboratory practice in museums because of its emphasis on bringing citizens into the messy practice of scientific research.

Calls to open up museums by collaborating with user groups (such as potential visitors), stakeholders (such as scientists, public historians, and other knowledge-producers), and other museums and cultural institutions (such as contacts between art and science museums) are epitomized by Nina Simon's influential book *The Participatory Museum* (2010). In it, Simon encourages cultural institutions to engage with their visitors as "cultural participants, not passive consumers" (Simon 2010, preface). Participation and collaboration have been particularly important in museums and galleries that display sensitive or contested histories and values, where it has become important to present voices that have traditionally been silenced or rendered subordinate (Krmpotich and Anderson 2005). But science museums have also engaged in public history or co-curation projects (Boon 2011; Stein 2012). Though many of these developments are concurrent with, and have made use of, the rise of digital and social media (Giaccardi 2012; Russo 2011), they have also involved face-to-face collaboration (Simon 2010) and— of particular importance for this discussion— the collective production of physical exhibition spaces.

Projects that form collaborations with scientists in order to bring working laboratories into museums (Hix and Heckl 2011; Meyer 2011) are connected to broader representational concerns to display not only the results (theories and "facts") of scientific practice, but also the

practices themselves: laboratory processes, structures of authority, and wider contexts and social controversies (Macdonald 2002; Yaneva et al. 2009). Such laboratories, in the words of the Darwin Centre at the Natural History Museum in London, allow visitors to "take a peek into the world of cutting-edge natural science research" (Darwin Centre 2014). Other prominent examples include the NanoToTouch laboratories in Munich (Deutsches Museum), Milan, and Gothenburg. Meyer (2011) describes these lab-in-museum projects as part of broader changes within the public (re)presentation of science, suggesting that putting research (and researchers) "on display" has the potential "to foster an interrogative approach" (268) and thus to both unsettle everyday laboratory practices and invite visitors to play an active part in this unsettling.

Both of these trends are linked to a general democratization of institutions of authority, such as museums, governmental structures, and universities. These democratizing projects pose specific challenges for museums. That said, museums are also particularly good places to think through their wider implications (Bennett, 1995). Moreover, museums are under direct pressure to "open up" and have relative flexibility in doing so, along with a material milieu in which negotiations over value and meaning are made usefully concrete.

Much of the recent research published on the challenges of museum co-curation has focused on involving community groups in cultural exhibitions (see Davies 2010; Golding & Modest 2012). This article focuses instead on collaboration with scientific institutions. Of the work that has been published on laboratories in museums, most has focused on representations of science or visitor participation (see e.g., Hix and Heckl 2011; Meyer 2011), with a substantial amount also having been written on artists

working in labs and with biohacking spaces (see Scott 2006; Bar Shai 2014). This article focuses instead on the *processes* of collaboration and on the material aspects of co-curation—the challenges of collectively producing a physical museum space together, rather than just representing different voices.

We reflect on these issues by using the notion of "hacking," central to the B: DIY project, as a means of both exploring the practice of co-curation and of focusing attention on material practice. We explore how different voices and perspectives were brought together in the museum, in part through the collaborative process of object selection, text production, and the construction of the lab/installation. This article describes both the practical issues that this collaboration entailed (how partners communicated, shared information, handled conflict, and managed finances) and issues concerning professional and group identities and roles, which may be threatened or changed through co-curation. In particular, we discuss the interests different partners have within this instance of co-curation and what different groups and individuals wanted from the project.

With regard to methodology, the project as a whole combined research and reflective practice (McMahon 1999); it aimed to produce both an exhibition product and knowledge about museum practice. Visitor experiences were not part of the research, which instead focused on co-curation with specific external actors rather than audiences. In order to allow the collection of material that provided different perspectives on the project, Sarah R. Davies (SRD) carried out interviews with all project participants as the project progressed. These group interviews were conducted twice—once before the space opened, and then again some months after the opening and associated events. Interviewees were grouped according to four

"roles": museum curators (n = 2), exhibition and graphic designers (n = 3 in the "before" interview, n = 2 in the second interview), the two collaborating biohackers (n = 2), and the university synthetic biology communication officers (n = 2). It is important to note, however, that, in practice, there was heterogeneity within these groups as almost everyone involved had a hybrid identity, (with for instance, one biohacker having a design background, and one of the designers working at the museum). Interviews focused on the participants' experiences of the project thus far, their understanding of its aims, and their impressions of its challenges and successes. The interviews were transcribed, and the analysis builds on this dataset, using it as a record of perspectives on the project at different points. In the discussion below, quotes are attributed to "roles" rather than to particular individuals.

HACKING, CO-CURATION, AND LABS IN MUSEUMS

The "hacker" and related "maker" movements, though diverse, generally emphasize creative problem-solving by using the skills and materials at hand (Anderson 2012). One frequently cited online definition of hacking is that it is the "clever circumvention of imposed limits" (The Well 2014). "Hackerspaces" are community-operated labs or workshops where people can meet and work on projects together, from building robots or developing software to using 3D-printers (Kostakis et al. 2014). The term "hacking" has now entered popular culture in this more positive sense—in addition to its previous associations with malicious computer hacking ("cracking")—such that websites and social media platforms based on "hacking" everyday life, domestic objects, or Ikea furniture (see Ikeahack 2014; Lifehack 2014) appear

alongside discussion of civic and political hacking (i.e. Liu, 2013).

The term "Biohacking"—also known as "do it yourself biology," "DIY bio," or "garage biology"—covers a range of activities that draws on the ethos of hacking described above. The focus is on hacking biological research, and the goal is to conduct research outside of university or industrial laboratories, in ways not possible within such institutions (Delfanti 2012; Seyfried et al. 2014). DIY bio spaces range from small, self-organized groups of enthusiasts to organizations, such as the BioCurious hackerspace (BioCurious 2014), that rent out spaces, hold workshops for children, and monetize their low-cost innovations. The outputs of biohacking can therefore vary, but have included simple demonstrations that can be conducted with kitchen equipment (such as extracting DNA from onions or working with traditional fermentation processes), open-source instructions for cheap laboratory hardware, bio-art, solutions to local agricultural challenges, and even attempts to compete with traditional biotechnology research laboratories (Delfanti 2012; Kera 2014; Seyfried et al. 2014).

One central goal of the biohacking movement is to liberate biological and biotechnological research from institutionalized laboratories, while emphasizing, variously, (self)education, democratic public involvement, or technological innovation (Delfanti 2013; Seyfried et al. 2014). As such, it has many of the same goals as projects that establish open labs in museums and science centers; the ambitions for NanoToTouch at Deutsches Museum were, for instance, to "create innovative environments for the broad public to learn about and discuss nanoresearch" and to "take the laboratory environment and the research work out of the enclosed academic campuses" (Hix 2009, 34, quoted in Meyer 2011, 262). Biohacking more-

over fits within broader museum agendas of participation and co-curation.

While publically exhibited laboratories (such as the Darwin Centre) are built and operated by scientists, biohacking labs are public. They invite people from outside the university system to build a laboratory space, construct instruments, and work on their own scientific projects. Aspects of biohacking thus resonate strongly with notions of co-curation as well as with the desire to "open up" science and its practices to laypeople. The inherently flexible nature of biohacking also makes it a good match for smaller or experimental museums that may struggle to find the financial and technical resources to reproduce university-standard laboratory practice. Creating a collaboration with biohackers was therefore a logical co-curation project for Medical Museion, one which promoted its aims to engage visitors in the practices of biotechnological research and experiment with participatory modes of collaboration (Söderqvist and Pedersen, 2013).

Constructing Biohacking: Do It Yourself!

In the rest of our discussion we use the interviews conducted with the project team to reflect on the process of collaboratively establishing the B: DIY lab/installation at Medical Museion. Before doing so, we briefly set the scene by describing the products of the B: DIY project as a whole. Figures 1 and 2 give a sense of the lab/installation. Medical Museion's Flickr stream—found at the web address https://www.flickr.com/photos/medicalmuseion/sets/72157632653594091/—includes more photographs of the exhibition, its objects, and the events held in it.

The original intention was to invite the two biohacker collaborators to "move in" to the museum, bringing their equipment with them

Figure 1. The Biohacking: Do It Yourself! lab/installation at the University of Copenhagen's Medical Museion. *Photo by Martin Malthe Borch. Creative Commons license: CC BY-NC-SA 2.0.*

along with any other members of the local bio-hacker space who wanted to participate. But practical constraints of access and fire regulations necessitated a compromise. Figure 1 shows the lab/installation, including hacked laboratory equipment, the refrigerator, microwave oven, and sink, and the ingredients and tools used to conduct simple DIY bio-demonstrations. Projected onto the cupboards on the right hand wall is a video of the project biohackers at work, intended to give a sense of activity when the room was not in use.

This is not, however, what most hackers would recognize as a hackerspace: the objects are displayed on a bench, neatly and with accompanying texts, as in a museum exhibit. Specific demonstrations are repeated rather than new experiments being pursued, and there is less of the clutter associated with ongoing

work that one would usually find in a community hackerspace.

As the lab/installation would not always be in use by the biohackers, a video of them working in it was made and then projected over the scene it depicted, so that even when visitors could not participate in hands-on activities, traces of action were visible. A hacked gene gun—a cheaply produced version of a classic laboratory device for injecting cells with plasmid DNA, developed during the project by one of the collaborating bio-hackers—was also displayed in the room (for a schematic, see Trojok 2012). Figure 2 shows the text board situated just outside the room that houses the project, which contained texts and photos compiled by the museum curators. These texts communicated basic background information about the biohacking movement, debates

Figure 2. The collage board located just outside the Biohacking: Do It Yourself! lab/installation. *Photo by Martin Malthe Borch. Creative Commons license: CC BY-NC-SA 2.0.*

around synthetic biology in a wider sociocultural and historical context, and concerns about the future of DIY science.

TRACING THE PROCESS OF COLLABORATION

In what follows, we chart some of the key dynamics that shaped the construction of this lab/installation under three key themes that emerged from the interviews: authenticity, professional identity, and material negotiations. As a starting point, however, it is useful to note that the interviews indicated that, to some extent, different partners had different initial aims. For the curators at Medical Museion the project was a contribution to the "Studiolab" EU project (Studiolab 2014). Studiolab was concerned with creating art/science collaborations and using them to encourage engagement in contempo-

rary scientific challenges, including those of synthetic biology (described by project partner the Center for Synthetic Biology as a technology that aims "to design and build biological systems with novel functions, by studying existing biological systems"). Medical Museion decided to approach the brief of using intersections of art and science to engage public audiences with synthetic biology by focusing on the hands-on, craft aspects of biotechnology, aiming to show the "behind the scenes" of what can appear to be impenetrably high-tech research. Because of its connections with DIY and the maker movement, as well as its drive to make science accessible, a link with biohacking seemed an ideal way to pursue these aims. In producing tools such as the gene-gun hack, biohacking takes a craft approach that demystifies laboratory procedures and opens the nature and regulation of genetic techniques up for debate

(see Tybjerg and Whiteley 2013). From the outset, the museum also saw the project as an experiment in co-curation.

For the biohackers, the genesis of the project was slightly different. For one of them, the project began with in a personal interest in creating a particular hacked instrument, the gene gun. The opportunity to reach new audiences with this innovation and also with the broader message of biohacking was important, as was the possibility of recruiting new members to the local hackerspace, and increasing public recognition of its work. The designers—one was based at Museion, the other two were external—were brought into the project after its initial conceptualization. The communication officers from the Center for Synthetic Biology also joined the project after its initial conceptualization, and were brought in primarily in relation to the project's events, for which communicating the Center's approach to synthetic biology clearly was a central goal.

Participants in the project thus arrived at it from different trajectories, and with differing interests. Project organization was informal and often ad hoc, with different actors—such as specialized designers—brought in as and when it was necessary. In keeping with ideals of co-curation, effort was made to collectively discuss key decisions, and also to avoid the formal, hierarchical structures that are common in some museums. Relatively little, with regard to authority and approval systems, was determined in advance. As the following discussion makes clear, in practice this became problematic as confusion regarding roles and responsibilities emerged.

As the project progressed, the development of the lab/installation brought the differing interests of the participants into relief; in the three sections below we describe how issues of authenticity, professional identity, and material negotiations came into play. We focus on the co-curation of the physical lab/installation, paying only limited attention to the development of the accompanying event series and to visitor experiences of the events and lab/installation itself. As such, most of the discussion below explores the relationship between the biohackers and museum curators.

1. Authenticity

Authenticity was a concern for several of those involved in producing the lab/installation. As stated above, the initial idea had been that Medical Museion would provide a space for a fully-functioning biohacking lab, in which the biohackers could work more or less continuously and which would bring the material culture and processes of hacking to a wider audience. But moving or re-establishing a full hackerspace in the very different institutional environment of a museum proved impossible on practical grounds, so a solution had to be established *de novo*. This dramatically opened up the field of possibilities for what the material set-up should look like, and thus for how biohacking would be presented and represented.

Features which were, to the biohackers, indispensable aspects of a hackerspace were not possible in the museum. They were "not allowed to drill holes in the wall [or] come in anytime we want" and there were "legal restrictions" on the kind of science they could carry out in a university-owned building (Interview 1, Biohackers). The space was thus, to the biohackers, ultimately an exhibition. This perception perhaps explains why, in early discussions, they imagined their work being exhibited in showcases (Interview 2, Designers). The Medical Museion curators, however, were clear that the space was exactly *not* meant to look and feel like a traditional museum exhibition, but to be

something closer to an "authentic" hacker-space. For one of the designers, this led to some professional challenges:

> sometimes I've had the experience of cheat-ing, you know, that I'm making decisions to make it look as if I have made no decisions... I have the feeling that a lot of the things that we have done in the space aren't honest, because it was museum people that went to IKEA and bought the furniture... we have this concept with the string that is somehow supposed to look a bit project room or workshop-like and I'm just putting up pictures in a very simple way. But it's very well thought through, so it's not honest in the sense that it didn't just evolve. (Interview 2, Designers)

Can an authentic biohacking lab be pro-duced by non-hackers? Or is this, as suggested, "cheating"? The curators were similarly ambiva-lent about what was being produced. If the "real" biohackers were not able to build their own lab from scratch, then this became the responsibility of others in the project; but, "if we do it," one curator said, "then it's not a biohacker lab because we are not biohackers" (Interview 3, Curators).

These questions of authenticity raise a number of issues. The concerns articulated above relate, for instance, to museological debates around the display of objects: what is the difference between an original and a replica? The challenge faced by Medical Museion forms part of the broader museological problem of how to understand and represent objects and material cultures in authentic and "truthful" ways. It is thus not surprising that anxiety around the authenticity of the B: DIY lab/installation was primarily articulated by the museum staff, who worried that they were "sitting between the chairs of authenticity and a

real curated exhibition" (Interview 3, Curators). For them, it was important that the material culture, processes, practices, and spirit of a DIY bio lab were presented faithfully.

The biohackers were less concerned by these problems of representation. Once it emerged that, on their terms at least, it was not possible to replicate a hackerspace environment within the museum, they viewed the space sim-ply as a site that could "exhibit hacks" to new audiences (Interview 1, Biohackers), but which was essentially different from the hacker culture they were immersed in. As such, its purpose was an instrumental one. They hoped that it might inspire visitors to visit a "real" hackerspace, and that the objects and techniques on display might encourage an interest in hacking; they also appreciated the "quality stamp" derived from biohacking's presence in the museum and its "museum aesthetics" (Interview 1, Biohackers).

So "authenticity" was never a real possibil-ity: the B: DIY lab/installation was created afresh, as different material cultures and materi-als were merged. In this sense, and as the cura-tors and designers came to realize, the lab/installation was in fact a "hack," a product made out of the available resources to serve a different function than that of the materials that went into it. Hacking is thus a useful metaphor for the products of co-curation, where the lines between the authentic object and the exhibition set-up—or between the represented and the representer—cannot be as carefully guarded as usual.

2. Professional Identity

Concerns about authenticity highlight the complexity of bringing together different mate-rial cultures within a collaboration such as the B: DIY project. Further practical challenges of co-curation are demonstrated by the manner in

which notions of professionalism rose to the surface, particularly how the finances were handled. The way that the project was funded (through an EC project, and via the University of Copenhagen) meant that the biohackers had to be reimbursed on an hourly rate as "student assistants" for their involvement. While a bureaucratic neccessity, and one with which everyone was unhappy (the museum would "much rather pay people in lumps," Interview 3, Curators), this further heightened problematic dynamics around role, ownership, prestige, and responsibility. For the biohackers, "we were employed as student helpers officially. And sometimes it felt like I was treated as a student helper" (Interview 6, Biohackers). For Medical Museion, on the other hand, "we were forced to employ people as if they were working hourly. And in a sense that turned their minds to think about it that way" (Interview 3, Curators).

Ultimately, these tensions led to the need to renegotiate, and make far more explicit, financial and moral ownership of the B: DIY project and products. By the end of the project, everyone who was interviewed offered up some kind of reflection along the lines that "it's very important to very early in the process clearly define who's doing what and at what steps in the process" (Interview 5, Communication Officers). Here, again, we see the practical impact of constraints imposed by institutional (and funding) structures and of the assumptions entwined with different institutional cultures.

Quite aside from their involvement in the B: DIY project, the biohackers were poised at an intersection between professional and amateur: they were about to finish their graduate studies whilst also attempting to develop biohacking as something that would support them in the future. This had a number of effects on the project. It meant, for instance, that the bio-

hackers had a number of competing claims on their time, that financing was important to them, and that they brought with them relaxed norms regarding working hours and deadlines. It was normal for them, for example, to work on projects in the early hours of the morning in the relaxed and open atmosphere of a hackerspace, something which wasn't possible at the museum. For Medical Museion, which was caught between the bureaucratic regulative demands of the University of Copenhagen (its institutional home and funding source), a corresponding need for "deliverables," and a university museum institutional culture this was at times frustrating. The project, one curator noted, had involved

> a meeting of a lot of different working cultures. It's been a meeting of non-professional, interest-driven work, the EU demands on the project, the demands of being a state institution... A lot of things we haven't been able to do as a state institution and so we had to be this kind of administrative mastadon that has met with voluntary working culture, and then on the other hand once we employed people to do stuff then we have an expectation that they show up roughly on the time we want them to... it's not been as professionally run as you normally see in a museum. (Interview 3, Curators)

Here, then, we see very different norms regarding professional behavior coming into contact—and resisting being "hacked." The way in which the biohackers were remunerated remained a sticking point throughout the project: they felt that their status as professionals had been ignored. Similarly, they felt that they were treated homogeneously, as a single "company" rather than as individual agents. On the other hand, the university's bureaucratic administration and the museum's institutional

norms concerning exhibition planning meant that the biohackers, at times, did appear "unprofessional," in that they didn't always "follow our deadlines and our sense of urgency and schedule" (Interview 3, Curators). Just as the creation of the B: DIY space revealed the challenges of bringing together different practice cultures, it also, then, brought the use of differing institutional and professional norms by different partners in the collaboration into relief.

The constraints imposed by the combination of different professional norms were exacerbated by the partners' differing perceptions of what each others' norms, constraints, and resources actually *were*. The museum assumed the hackers would just "get stuck-in" and set up the lab in their usual way. And the hackers assumed that the museum had readily available resources for exhibition creation, and that it should simply take on this aspect of the project. Both underestimated the other's resource constraints, and perhaps failed to recognize that one of the attractions of the project on both sides was exactly *not* to behave as normal, and thus *not* to suffer normal constraints. The biohackers wanted professional employment as consultants (rather than compensation for creating a new hackerspace) and to play a more officially recognized educational role. On the other hand, the museum wanted the biohackers to treat them as novice partners in a new hackerspace project rather than as employers. In other words, both parties wanted to have their professional roles perturbed, whilst implicitly expecting the other to follow what they perceived as standard professional obligations.

3. Material Negotiations

As these discussions of authenticity and professional identity demonstrate, constraints on achieving co-curation emerged in relation to practical, professional, design, and communication issues. But these constraints were not evident in initial discussions of a shared vision, where the different goals that partners brought to the table were less visible. Rather, constraints emerged as part of the practical process of materializing the lab/installation: setting up the space, selecting objects, and deciding what would be written and said about it.

As discussed above, the biohackers did not want to "design" the room, arguing that the look of the laboratory is not important and should evolve organically according to the needs, interests, and available resources of any new hackerspace. For them, the "aesthetic" was simply not a priority:

> they [Medical Museion] have a more entertaining perspective or this aesthetic perspective. Well, I'm from the science side and I want to bring content through. So I want to get information out. And it is—for me, I mean, okay it's nice if I see something beautiful, I like that as well, but here the point is to get the message out. (Interview 1, Biohackers)

But the museum was interested in sharing not just the "message" of biohacking, but also the appearance and atmosphere of the biohacking lab. It therefore wanted to present the distinctive, if diverse, aesthetics of hackerspaces. In the end, the museum took the overall design decisions—with advice from the hackers—on what was needed for experiments. Sub-tasks of acquiring and assembling furniture were then divided up between the project partners most able to fulfill them. Though this solution was less truly collaborative than "building together" would imply, the process of wrangling and task allocation was arguably more collaborative than would have been the case if either museum or hackers had simply set up the space themselves.

Filling the surfaces, cupboards, and shelves of the room with objects also required negotiation. Once the room had been framed as a lab/installation where the overall aesthetic and ambience would be led by the curators and designers, the selection and placing of objects started to matter more. The museum now felt responsible for it being a "good exhibition," even if it was a hybrid one, and resisted efforts by the biohackers to simply load the shelves. If nothing else, this process could be time consuming: "at the beginning," one of the designers noted, "I felt like we were all standing in the room and there were seven of us deciding on where to put a chair" (Interview 2, Designers). For both furniture and objects, co-curation was eased because of their capacity to express the differing priorites of the partners: objects could be found that satisfied both the biohackers' functional needs and the curators' and designers' aesthetic needs. This "capacity" was both physical—there was enough room in the lab/installation to include multiple objects—and conceptual: objects could be perceived in multiple ways simultaneously.

In contrast, the exhibition texts used a single voice, and choices had to be made as to how they were written. As such, the writing of these texts brought to light important differences in how the audience was imagined, and what the purpose of science communication was understood to be. For instance, the museum staff wanted to frame the lab/installation by communicating the context and origin of the biohacking movement, whilst limiting the amount of technical content in the texts in order to make them widely accessible. But one of the biohackers worried about this appearing simplistic to a scientific audience, and wanted to provide fuller information. In the end, some partners prioritized the lab/installation's accessibility to visitors without an existing expertise in science

(at the close of the project, the curators still felt that "a little bit more hand-holding [was needed] in terms of telling people what [it was] about" (Interview 7, Curators). Others were less concerned about losing non-expert visitors in favor of recruiting future advocates and participants to the biohacking movement.[3]

These differences of perspective—who the primary audience was and what information it needed—became evident as specific texts had to be written and agreed upon. Discussions about how texts were framed and positioned also revealed quite divergent ideas about the purpose of communication of "behind the scenes" science (such as that in labs in museums). Most partners felt that the lab would enable audiences to get a more realistic picture of how biotechnology works from a sensory as well as a conceptual perspective. Where they differed was on what the effects of this would—and should—be. Some imagined that better public understanding of the practices of biohacking would create more positive attitudes to both the movement and to controversial research in genetic modification and synthetic biology. Others felt that the purpose was primarily to offer an encounter with science, and still others valued raising the question posed by biohacking—of who has access to science—in a more open-ended way.

The difficulties posed by textual communication were thus more acute than for the selection of objects, where the primary disagreement was how cluttered the room should be—rather than what that clutter should consist of. This is perhaps telling of a broader theme in co-curation: the capacity of textual communication is more limited than that of object-based communication. The latter allows of dissonant plurality in a way that the former does not. Styles of approach can be blended more easily through materialities than in texts.

The events held at B: DIY provide an interesting third medium here: like the assemblage of objects, the assemblage of voices in an event allowed people to speak for themselves, rather than in competition with each other for limited, authoritative text. But despite these variable degrees of co-curation across the different media, looking at the lab/installation as a whole, different "voices" were indeed present in the blend of physical environments and the interwoven patchwork of texts. In other words, even if museum practice was not extensively hacked, the lab/installation can itself be seen as a hack that represented the collaboration.

CONCLUSION

As described in the introduction, the collaboration described above is in line with recent calls for participation and co-curation. Specifically, it can be understood as an attempt to move beyond only representing different voices within the museum, to co-developing the physical structure of an exhibition as well as the events that accompany it. The concrete goal of the collaboration reported here was to bring the "behind the scenes" of science into the museum, through the creation of a biohacking lab and hands-on public engagement events. It was thus meant to involve visitors in the practices of science by exhibiting and enacting a movement whose goals include precisely that. Our interviews have allowed us to discuss this process not just in terms of the multiple voices present in the final exhibition, but also with regard to how different interests were expressed —and different assumptions about the museum and about the purposes of communicating science were articulated—during the project. "Hacking" stands as both a concrete example of co-curation, and a metaphor for the process of co-curating.

Importantly, the interview material revealed different ways of describing the project's goals, organization, and nature, as well as different ways of perceiving the professional roles and resources of the partners. The goal of the museum was to use the hands-on activities of biohacking to give a sense of the craft and practice of working science, and to do so by working like—as well as with—biohackers. The biohackers were interested in working with the museum because it is visited by a much broader segment of the public than hackerspaces, enabling them to take up a wider educational role. The university museum also provided an authoritative platform that promised to legitimize the activities of the biohackers. This increased their contacts with institutional stakeholders, who are increasingly interested in the potential of citizen science movements. And, in terms of basic resources, the biohackers had practical skills and technical objects the museum lacked, while the museum had funds, as well as a framework for setting up exhibitions and public events. Both groups thus wanted to appropriate features that they associated with other partners in the collaboration, as well as to draw on resources that they perceived the other party to have. But both overestimated the other's resources, and underestimated the degree to which the other's desire to take on new roles echoed their own. In order to truly co-curate, in order to *be hacked*, borrowing from each other's practices and resources must go beyond appropriation to include an understanding that all partners will be changed through the encounter.

In the interviews, one of the biohackers described a project in which he wanted to build something that required electronics skills he did not have. The solution that was devised was to ask someone with those skills to work on the project with him, so he could learn and create at the same time rather than simply contracting

out the electronics part of the work. All partners, at least initially, wanted to follow this "hacker spirit" of building together. However, as we have discussed, the project team was faced with a range of constraints that often resulted in a division of space, voice, or task, rather than truly collaborative modes of work. At the same time, the final lab/installation product can be seen as a successful "hack" in the sense that its production drew on the skills and resources to hand in order to satisfy a range of intersecting agendas in ways that departed from each individual partner's typical practice. One of the most important lessons from the analysis reported here is, therefore, that making the most of opportunities for co-curation requires extending our understanding of it beyond the inclusion of new participating voices and to the physical set-up itself. In other words, it is not just the narratives of museum exhibitions, but also their materialities and producers that will be hacked through co-curation. All sides in a collaboration are there to achieve (and become) something new, and not just to deliver resources and a standard service. Co-curation, therefore, cannot only be understood as the way in which different interests interact, but rather as a process by which they are re-shaped—in the form of new identities, cultures, and professional trajectories—through those interactions.

As a final point we want to return briefly to the utility of biohacking for thinking through the second trend discussed at the start of this paper, that of moving laboratories into the museum. At the outset of this project, Medical Museion chose to work with a biohacker group in preference to working with a university bioscience group. In some ways, it might have been easier to work with a more traditional laboratory, which might have been a better institutional and organizational "fit" with museum and university bureaucracy. However,

hackerspaces have inherent democratizing ambitions which aim to open up scientific practice to public audiences. Despite the constraints we have described, we would argue that the match is worth pursuing further. The ideological resonances are a good basis for exploring new forms of participatory science communication; the practices of hacking are more open to visitors (and more affordable) than conventional laboratory science; the hacking approach is fundamentally open to different partners producing shared products; and the goals and practices of hackers are less institutionally constrained than those of many scientists. There should be further opportunities, we would suggest, for (bio)hackers, curators, and others to hack our museums.   **END**

NOTES

1. Our choice of the term "lab/installation" to describe the space was problematic, and highlights the ultimately hybrid nature of the

final product of the project (as further discussed in the rest of the article). Was it an "exhibition," with the connotations this brings of a relatively static, didactic space? Was it an "installation," evoking the artist's creative play with content? Was it a "laboratory," connoting a space for the production of new empirical knowledge? Or was it a "hackerspace," even though it was not built by a bottom-up hacker community? None of these labels alone quite fits. We also sought to avoid the imprecise term "space" in relation to museums. For the purposes of this article we therefore use "lab/installation" as a default, using other terms such as "room," "exhibit," or "hackerspace" where appropriate to the immediate context.

2. Given that this article addresses the notions of co-curation and participation, it is important to note that it is written only by selected actors within the larger project team. It was written by the project curators from Medical Museion (KT and LW), the museum director (ThS), and a Science and Technology Studies scholar who conducted interviews with the project team (SRD). While the research that we discuss sought to give space for the diverse perspectives of the partners, there is, inevitably, an imbalance with regard to who is given voice in this particular discussion of the B: DIY project. However, a draft version of the text prior to submission to *Curator* was circulated to all participants in the project, and changes made in response to feedback on it. Comments were in agreement that the text is a good representation of the key issues that emerged within the project.

3. We noted above in the description of interview methodology that the actors' categories we work with in this paper were in practice not homogeneous. This is one example: there was some difference between the attitudes of the two collaborating biohackers with regard to how the central messages of the lab/installation should be displayed.

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